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The pharmacognostic study of the aerial part of *Prangos ferulacea lindl*. at the stage of the beginning of vegetation

Aim. To study the coumarin composition of salted Prangos ferulacea herb collected at the stage of vegetation and compare it with the coumarin composition of the freshly collected raw material.

Materials and methods. The analysis was performed using Agilent 5977 GC and 7890B MS devices. The carrier gas was helium with a constant flow of 1 ml/min. The data of NIST library of standard mass-spectra were used to identify compounds.

Results and discussion. The results of the study of coumarin derivatives in the food additive prepared from Prangos ferulacea herb collected at the beginning of the vegetation period are presented. The anatomical structure of the aerial part of Prangos ferulacea has been studied, and the diagnostic features of the plant raw material have been identified.

Conclusions. The composition of coumarin derivatives in the food additive and in the freshly collected aerial part is identical. The diagnostic features of the structure of the plant raw material of Prangos ferulacea have been identified.

Key words: Prangos; coumarins; gas chromatography-mass spectrometry; microscopy

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Фармакогностичне дослідження надземної маси *Prangos ferulacea lindl*. в стадії початку вегетації

Мета роботи – вивчити кумариновий склад засоленої трави *Prangos ferulacea*, заготовленої у стадії вегетації, і порівняти його з кумариновим складом свіжозаготовленої сировини.

Матеріали та методи. Аналіз проводили на Agilent 5977 GC і мас-спектрометрі газової хроматографії 7890B MS. Газ-носій – гелій з постійним потоком 1,0 мл/хв. Для ідентифікації сполук використовували дані бібліотеки стандартних мас-спектрів NIST.

Результати та їх обговорення. Наведені результати вивчення похідних кумарину в харчовому продукті, виготовленому з трави *Prangos ferulacea*, заготовленої на початку вегетаційного періоду. Вивчено анатомічну будову надземної частини *Prangos ferulacea* і встановлені діагностичні ознаки будови рослинної сировини.

Висновки. Склад похідних кумарину в дієтичній добавці і свіжозаготовленій надземній масі ідентичний. Встановлені діагностичні ознаки будови сировини *Prangos ferulacea*.

***Ключові слова**:* прангос; кумарини; мас-спектрометрія газовою хроматографією; мікроскопія

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Фармакогностическое изучение надземной массы *Prangos ferulacea lindl.* в стадии начала вегетации

Цель работы – изучить кумариновый состав засоленной травы *Prangos ferulacea*, заготовленной в стадии вегетации, и сравнить его с кумариновым составом свежезаготовленного сырья.

Материалы и методы. Анализ проведен на Agilent 5977 GC и масс-спектрометре газовой хроматографии 7890B MS. Газ-носитель – гелий с постоянным потоком 1 мл/мин. Для идентификации соединений использованы данные библиотеки стандартных масс-спектров NIST.

Результаты и их обсуждение. Приведены результаты изучения производных кумарина в пищевом продукте, приготовленном из травы *Prangos ferulacea*, заготовленной в начале вегетационного периода. Изучено анатомическое строение надземной части *Prangos ferulacea*, установлены диагностические признаки растительного сырья.

Выводы. Состав производных кумарина в диетической добавке и свежезаготовленной надземной массе идентичны. Установлены диагностические признаки строения сырья *Prangos ferulacea*.

***Ключевые слова**:* прангос; кумарины; масс-спектрометрия газовой хроматографией; микроскопия

The representatives of *Apiaceae* family, and in particular *Prangos* genus, are characterized by the content of essential oils, coumarins, furocoumarins and other substances [1, 2]. Coumarins and furocoumarins of *Prangos* species have a variety of pharmacological properties [1, 3, 4]. *Prangos* genus in the flora of Azerbaijan are represented by five species [5]. Since olden times in early spring the local population prepare a food additive (pickle) under the name of "chashir" and a water distillate (chashir aragy) from the aerial part of *Prangos ferulace*, they are used to improve digestion, as well as in spasms in the abdominal area [6]. The chemical composition of this food additive is unknown; therefore, the aim of our work is to study the coumarin composition of salted *Prangos ferulacea* herb collected at the stage of vegetation and compare it with the coumarin composition of the freshly collected raw material. To determine the diagnostic signs of *Prangos ferulacea* herb it was necessary to study its anatomical structure.

Materials and methods

The analysis was performed using Agilent 5977 GC and 7890B MS devices. The column size was 30 m with the internal diameter of 0.25 mm, and the film thickness of the stationary phase was 0.25 μ (HP-5 MS Ultra Inert). The carrier gas was helium with a constant flow of 1 ml/min. The initial temperature of 80 °C maintained for 5 min, then for each minute the temperature increased by 20 °C, reached 220 °C and retained for 4 min; after that there was the programmed rise in temperature up to 5 °C/min to a constant temperature of 280 °C. The data of NIST library of standard mass-spectra were used to identify compounds (Table).

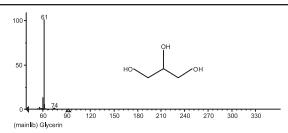
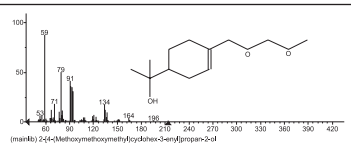
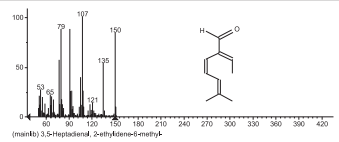
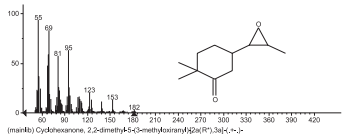
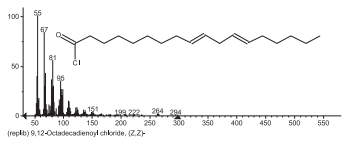
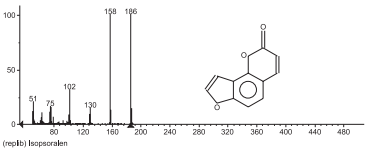
The microscopic examination of the anatomical structure and detection of diagnostic features were performed using the known methods [7].

Results and discussion

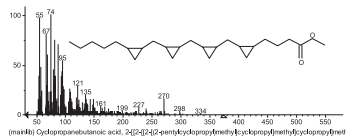
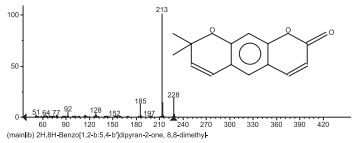
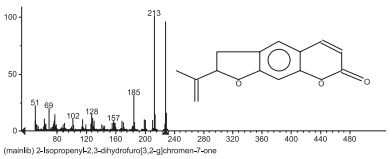
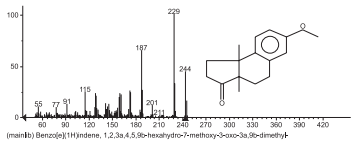
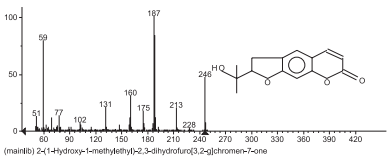
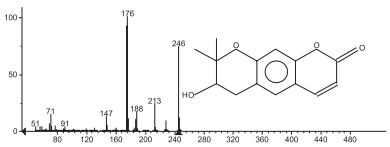
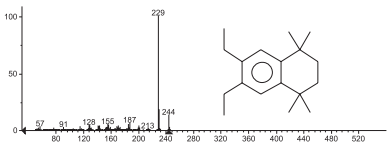
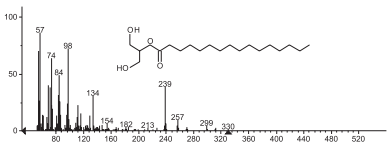
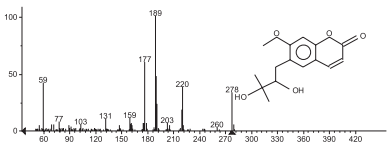
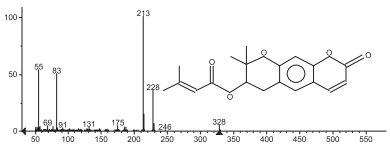
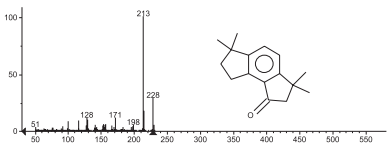
After concentration the alcoholic extract of the aerial part of *Prangos ferulacea* herb collected at the stage of vegetation was treated with hexane. Then it was analyzed by the method of gas chromatography-mass spectrometry. As it can be seen from Table, this extract contains 14 components, 7 of them refer to coumarin compounds: isopsoralen; 2H,8H-benzo[1,2-b:5,4-b']dipyran-2-one,8,8-dimethyl-; 2-isopropenyl-2,3-dihydrofuro[3,2-g] chromen-7-one; 2-(1-hydroxy-1-methylethyl)-2,3-dihydrofuro[3,2-g] chromen-7-one; (S)-7-hydroxy-8,8-dimethyl-7,8-dihydropyrano(3,2-g)chromen-2(6H)-one; 2H-1-benzopyran-2-one,6-(2,3-dihydroxy-3-methylbutyl)-

Table

Chemical compounds of the amount of extractives of the *Prangos ferulacea* aerial part at the beginning of the vegetation period

The formula of the compound	The name of the compound	Peak area	Retention time, min
1	2	3	4
	Glycerin	5.66 %	4
	2-[4-(Methoxymethoxymethyl)cyclohex-3-enyl]propan-2-ol	1.13 %	10.256
	3,5-Heptadienal, 2-ethylidene-6-methyl-	1.19 %	10.569
	Cyclohexanone, 2,2-dimethyl-5-(3-methyloxiranyl)-, [2α(R*),3α]-(.+-.)-	1.01 %	10.665
	9,12-Octadecadienoyl chloride, (Z,Z)-	0.67 %	12.296
	Isopsoralen (Furo[5',4':7,8]coumarin)	1.99 %	13.409

Continuation of Table

1	2	3	4
	Cyclopropanebutanoic acid, 2-[[2-[[2-[(2-pentylcyclopropyl)methyl]cyclopropyl] methyl]cyclopropyl]methyl	1.58 %	13.904
	2H,8H-Benzo[1,2-b:5,4-b']dipyran-2-one, 8,8-dimethyl- (8,8-Dimethyl-2H,8H-pyrano[3,2-g]chromen-2-one)	3.13 %	15.932
	2-Isopropenyl-2,3-dihydrofuro[3,2-g]chromen-7-one (2-Isopropenyl-2,3-dihydro-7H-furo[3,2-g]chromen-7-one)	1.36 %	17.356
	Benzo[e](1H)indene, 1,2,3a,4,5,9b-hexahydro-7-methoxy-3-oxo-3a,9b-dimethyl- *Synonyms*: 7-Methoxy-3a,9b-dimethyl-1,2,3a,4,5,9b-hexahydro-3H-cyclopenta[a]naphthalen-3-one	1.36 %	18.616
	2-(1-Hydroxy-1-methylethyl)-2,3-dihydrofuro[3,2-g] chromen-7-one *Synonyms:* 2-(1-Hydroxy-1-methylethyl)-2,3-dihydro-7H-furo[3,2-g]chromen-7-one	11.03 %	19.347
	(S)-7-Hydroxy-8,8-dimethyl-7,8-dihydropyrano(3,2-g) chromen-2(6H)-one *Synonyms:* 7-Hydroxy-8,8-dimethyl-7,8-dihydro-2H,6H-pyrano[3,2-g]chromen-2-one	2.34 %	19.971
	Naphthalene, 6,7-diethyl-1,2,3,4-tetrahydro-1,1,4,4-tetramethyl-	4.08 %	21.347
	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	7.93 %	22.183
	2H-1-Benzopyran-2-one, 6-(2,3-dihydroxy-3-methylbutyl)-7-methoxy-, *Synonyms:* (±)-6-(2,3-Dihydroxy-3-methylbutyl)-7-methoxy-2H-chromen-2-one	46.41 %	22.679
	(S)-8,8-Dimethyl-2-oxo-7,8-dihydro-2H,6H-pyrano(3,2-g)chromen-7-yl 3-methyl-2-butenoate (Decursin)	6.63 %	25.565
	As-Indacen-1(2H)-one, 3,6,7,8-tetrahydro-3,3,6,6-tetramethyl	2.48%	26.130

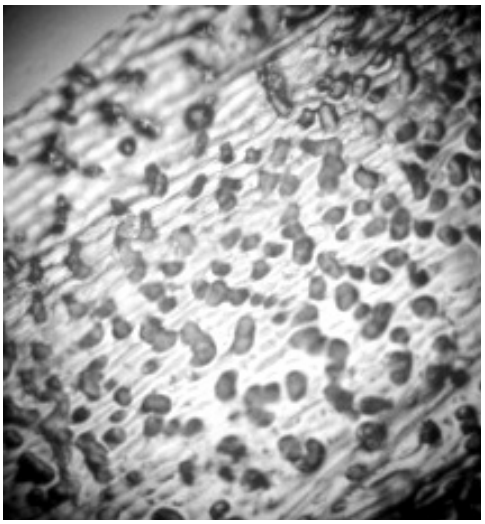


Fig. 1. Glands on the epidermis of the stem

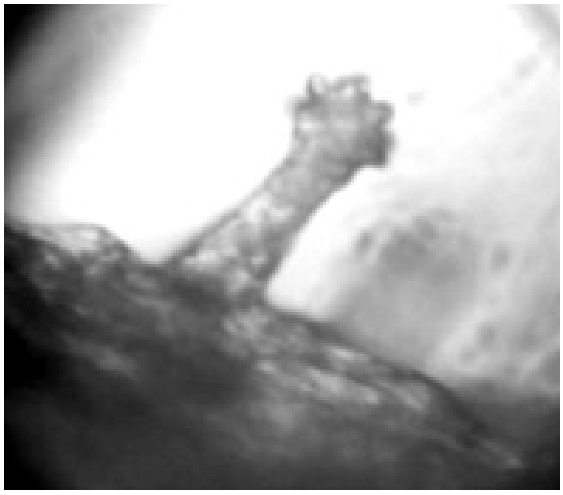


Fig. 3. A gland on the leaf surface

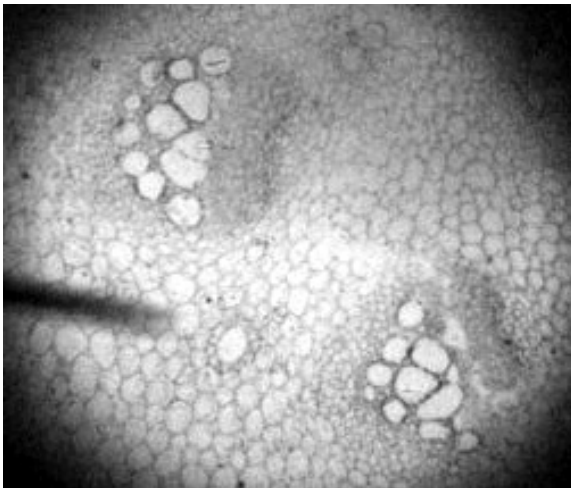


Fig. 2. Schizogenic spaces and vascular bundles on the cross section of the stem

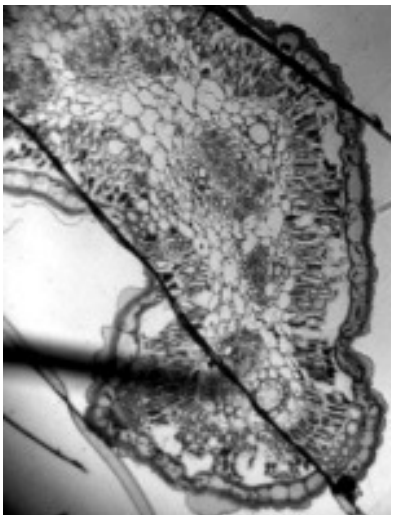


Fig. 4. The cross section of the leaf

7-methoxy-; (S)-8,8-dimethyl-2-oxo-7,8-dihydro-2H, 6H-pyrano(3,2-g)chromen-7-yl; 3-methyl-2-butenoate. In percentage terms such coumarin derivatives as 2H- 1-benzopyran-2-one,6-(2,3-dihydroxy-3-methylbutyl)-7-methoxy- (46.41 %); 2-(1-hydroxy-1-methylethyl)- 2,3-dihydrofuro[3,2-g]chromen-7-one (11.03 %) prevail. The remaining 10 components belong to different classes of compounds.

There is a large number of glands on the epidermis of the stem (Fig. 1). On the cross section of the stem along the entire surface of the cut there are clearly visible schizogenic spaces and vascular-fibrous bundles of the closed type where the layer of cambium between the phloem and xylem is absent (Fig. 2). The glands consist of a stalk and a spiked round top (Fig. 3).

On the cross section of the leaf the large and small vascular bundles surrounded by the magnocellular parenchyma and a schizogenic space are observed (Fig. 4).

CONCLUSIONS

1. *Prangos ferulacea* herb at the beginning of vegetation contains isopsoralen; 2H,8H-benzo[1,2-b:5,4-b']dipyran-2-one, 8,8-dimethyl-; 2-isopropenyl-2,3-dihydrofuro[3,2-g]chromen-7-one; 2-(1-hydroxy-1-methylethyl)-2,3-dihydrofuro [3,2-g]chromen-7-one; (S)-7-hydroxy-8,8-dimethyl-7,8-dihydropyrano (3,2-g) chromen-2(6H)-one; 2H-1-benzopyran-2-one, 6-(2,3-dihydroxy-3-methylbutyl)-7-methoxy-; (S)-8,8-dimethyl-2-oxo-7,8-dihydro-2H,6H-pyrano(3,2-g)chromen-7-yl 3-methyl-2-butenoate (±)-coumarin derivatives.

2. The coumarin composition in the freshly collected and salted *Prangos ferulacea* herb is identical.

3. The structure of the glands and schizogenic spaces are diagnostic features of the anatomic structure of the plant raw material.

Conflict of Interests: authors have no conflict of interests to declare.

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